Harding Lawson Associates

January 13, 1999

Mr. Gary N. Yamamoto, P.E., Chief
South Coast Region
Drinking Water Field Operations Branch
Department of Health Services
1449 West Temple Street, Room 202
Los Angeles, CA 90026

Re: Response to Comments:
"Draft Phase 2 Treatability Study Work Plan Perchlorate in Groundwater, Baldwin Park Operable Unit, San Gabriel Basin, California"

Dear Mr. Yamamoto:

Transmitted under separate cover you should have received a copy of our revised document entitled "Draft Phase 2 Treatability Study Work Plan, Pilot Scale Groundwater Treatment System, Baldwin Park Operable Unit, San Gabriel Basin, California, dated October 29, 1998. We believe that this draft work plan addresses your comments dated July 10, 1998. We look forward to continuing our work with the Department of Health Services (Department) to resolve any outstanding concerns and proceed with implementation of this study. We apologize for the delay in providing you these responses to your specific comments. We hope to have fully addressed these issues in our revised work and through our meetings. Our responses to the Department's comments are detailed below.

Page 1 states "Finally, the result of the treatability study indicate that the effluent water quality (following disinfection and filtration) should meet all applicable standards for use as potable water." Again, this statement should be deleted for the reason mentioned earlier (Item 5 above).

Response: This statement in the Phase 2 Treatability Study Work Plan has been revised to read: "Finally the Phase 1 treatment system was not designed to produce potable water. The Phase 2 Pilot System will consist of a treatment train identical to the treatment train proposed for the full-scale system and will include all of the unit processes required to produce potable water." The Phase 2 treatment system will be operated and monitored to ensure and document the potability of the effluent water.

1. According to the work plan, a high-rate, multimedia filtration system will be added to the Phase 2 treatment train. Page 8 states "Multimedia filtration using filter loading rates of between 4 and 6 gpm per square foot will be evaluated for performance effectiveness. Based on initial treatability results, higher filter loading rates may be considered for further evaluation." If the filtration system is going to be operated at a higher loading rate than the flow rate specified in Title 22, Section 64660 (b), a study should be performed to demonstrate that the filtration system can comply with the performance requirement of Title 22, Section 64653 (Title 22, Section 64660 [4]). A study protocol should be submitted to this office so that we could forward it to our Internal Surface Water Treatment Committee for review and approval.

   Response: The multimedia filtration system will be initially operated at 4 gpm per square foot. Two filters will be used to allow for continuous plant operation, operation flexibility, and the evaluation of the optimal filter loading rate. If the filtration system is going to be operated at a higher loading rate than the flow rate specified in Title 22, Section 64660 (b), a study protocol will be submitted to the Department to ensure the system can comply with Title 22, Section 64653 (Title 22, Section 64660 [4]).

   We could not find detailed design information on the filtration system. The only piece of information we found is on Page 8 stating "The filtration system will include a filter-aid polymer feed system and turbidity meters." It appears to us that the proposed treatment train does not include coagulation, flocculation and sedimentation processes.

   Response: Conceptual design information on the multimedia filtration system is presented in Sections 5 and 6 of the Phase 2 Treatability Study Work Plan. The multimedia filters will be operated in a biologically active mode. A polymer will be added to the bioreactor effluent to promote removal of suspended solids in the multimedia filters. The proposed treatment train does not include coagulation, flocculation, or sedimentation processes. We believe that effluent from the bioreactor will have a sufficiently low loading of suspended solids that coagulation, flocculation and sedimentation will be unnecessary. If initial testing results do not support this assumption, consideration will be given to adding this unit process. Please refer to Figure 5.1 for a graphical presentation of the proposed treatment system.

   The Department will evaluate the bioreactor effluent in a similar manner as a surface water source. Similar to the compliance with the Surface Water Treatment Rule, first, the effluent from the bioreactor should be an **approved water source**. In order to obtain an approval from the Department for the bioreactor effluent as a water source, the information on the total coliform concentration in the bioreactor effluent and pathogen analysis results must be submitted to the Department. It is the Department policy that any source with the median monthly total coliform concentration exceeding an MPN of 100,000/100ml will not be considered as a water source.

Response: Analysis of the bioreactor effluent including total coliform, pathogen analysis, and other analysis to secure approval as an approved water source will be submitted to the Department. This will be further detailed in the Sampling and Analysis Plan (SAP).

Second, multi-barrier treatment train should be able to at least provide (1) a total of 99.9 percent reduction of Giardia cysts through filtration and disinfection; and (2) a total of 99.9 percent reduction of viruses through filtration and disinfection. If the bacteriological quality of the bioreactor effluent is worse than those expected in a reasonable quality source, higher removal credit will be required.

Response: The multi-barrier treatment train is designed to provide a 99.9 percent reduction of Giardia cysts and viruses through filtration and disinfection. We understand that a higher removal credit may be required if the bioreactor effluent quality is worse than expected in a reasonable quality source.

The proposed treatment train does not fit in any filtration technology categories specified in Title 22, Section 64653 (a). According to Title 22 Section 64653 (f), the operator of the treatment system shall demonstrate to the Department that the proposed treatment train must (1) provides a minimum of 99 percent Giardia cyst removal and 90 percent virus removal and (2) meets the turbidity performance standards established in Section 64653(c) before a permit could be issued. We noticed that the turbidity in the bioreactor effluent got as high as 34 NTU in Phase 1. According to our experience, pretreatment (coagulation and flocculation) and sedimentation should be provided to ensure the performance standard could be meet. [sic]

Response: We understand the treatment train must provide adequate Giardia cyst and virus removal, and meet turbidity performance standards before a permit can be issued. Turbidity in the bioreactor effluent will be monitored, although individual measurements of the turbidity of bioreactor effluent were in the range of 30 NTU, these measurements were made while the system was under modification. The effluent turbidity was documented to be less than 10 NTU under normal operating conditions and we expect turbidity in the range of 2-5 NTU for the Phase 2 system.

2. As mentioned previously, the treatment train should be able to provide 3 logs or higher Giardia reduction and 4 logs or higher viruses reduction through the filtration and disinfection processes. Depending upon what removal credit granted to the high-rate, multimedia filtration system, the remaining reduction credit should be provided by the disinfection process.

Response: Agreed. The Phase 2 system will be designed to attain these standards.

The work plan proposes the use of sodium hypochlorite as the disinfectant. Page 7 of the work plan states "After the effluent exits the bioreactor, it will flow by gravity to an equalization/disinfection tank equipped with level controls. From the equalization tank, the effluent will be pumped to the air stripper

with disinfection occurring en-route." This is the only disinfection point proposed for the treatment train. Two issues arise here: 1) is the chlorine the best disinfectant of choice? (considering the formation of DPB, etc.); and (2) the disinfection process described in the plan looks more like air stripper bio-fouling control. Unless extremely high dosage is used here (which is not advisable considering DBP formation), it is very likely that not enough residual would remain at the distribution system entry point.

Response: The treatment train has been modified significantly from the previous submittal of this work plan. Please refer to Figure 5.1 for a graphical overview of the treatment train. Disinfection will be the last process in the treatment train. Only 5 gpm will be treated in the disinfection system; the balance will be discharged to Walnut Creek. The disinfection system is designed to use sodium hypochlorite; it is anticipated that approximately 0.2 lb per day of chlorine will be used to produce a chlorine residual of 0.2 mg/L. The current treatment system configuration provides multiple barriers for removal of precursors to DBP formation. These barriers include the multi-media filters, UV/oxidation, and liquid-phase granular activated carbon (LPGAC). In addition, DBP formation will be evaluated as part of the Phase 2 Treatability Study. We look forward to working with the Department in evaluating the optimal disinfectant if chlorine is found to be unacceptable.

We believe a study on the DBP (total trihalomethanes (THMs) and other by-products, such as aldehyde, haloacetic acids (HAA5), etc., depending on what disinfectant is chosen for the study) should be performed. Also, we believe a post-disinfection unit should be provided to meet the CT_{10} (disinfectant residual concentration, C in mg/L times, contact time, T_{10} in minutes) requirement of the SWTR. A tracer study should be conducted for the disinfection basins to establish the contact time for the CT_{10} calculation. Residual disinfection concentration should be measured at different points based on the locations of disinfection points so that CT_{10} calculation could be performed. In addition, to ensure the performance standard could be met, the disinfection residual should be measured and recorded continuously at the end of the treatment train.

Response: DBP formation will be evaluated as part of the Phase 2 study. Details regarding data collection to support this evaluation will be submitted in the Sampling and Analysis Plan (SAP). Appropriate tracer studies will be included. The disinfection system in the Phase 2 Treatability Study is designed to allow for evaluation of the CT_{10} requirements of the SWTR. Residual concentrations will be measured at different points in the disinfection system so that the CT_{10} calculation can be performed. If data from the study appears promising, disinfection residual will be measured and recorded continuously at the end of the treatment train.

3. Page 6 states that "the microorganism innoculum will be characterized." How will the microorganism innoculum be characterized?

Response: The innoculum will be characterized for bacteriology (total and fecal coliform and heterotrophic plate count), Giardia and Cryptosporidium, and Viruses. If the Department has other test which it recommends please produce a list of these tests as soon as practical.

4. Page 7 states that "there was an initial concern that biological treatment of water containing VOC's may produce unwanted by-products (e.g. vinyl chloride). The Phase 1 Treatability Study demonstrated that this is not the case and that air stripping can be performed following biological treatment." The matrix of San Gabriel water is different from the water tested in Phase 1. There is no guarantee that the PCE/TCE will not breakdown into vinyl chloride, which is difficult to remove by air-stripping.

   Response: The treatment train in the Phase 2 Treatability Study Work Plan has been modified to address the presence of nitrosodimethylamine (NDMA) and 1,4-dioxane in BPOU groundwater. NDMA is neither adsorbable nor strippable, but can be effectively destroyed by ultraviolet (UV) irradiation. UV irradiation, with the addition of an oxidizing chemical (e.g. hydrogen peroxide), is also an effective treatment for removal of VOCs and 1,4-dioxane. Therefore, air stripping, which was originally proposed for VOC removal, was replaced with UV/oxidation. Liquid-Phase Granular Activated Carbon (LPGAC) contractors were also added for removal of carbon tetrachloride, which is not removed by UV/oxidation. The revised treatment train should provide effective multi-barrier treatment of VOCs.

5. Optimization of phosphorus loading should be performed during Phase 2.

   Response: We agree. Phosphorus loading will be optimized during the Phase 2 Treatability Study.

6. Page 4, the objective of the Phase 2 study includes "Filter and disinfect treatment plant effluent and monitor the quality of this effluent to assure that the water will meet drinking water standards." However, chlorine residual testing was not mentioned in the plan. The project should demonstrate that a disinfectant residual of a least 0.2 mg/L could be maintained at the plant's effluent at all times.

   Response: We agree. The Phase 2 treatability Study Work Plan disinfection system is designed to provide a disinfectant residual of at least 0.2 mg/L in the plant effluent at all times.

7. Steady state condition should be reached and sufficient data must be gathered before changing operational parameters. The criteria for measuring steady state should be provided.

   Response; We agree. Based on the Phase 1 Treatability Study results, we expect 24 hours or less for steady state to be reached in the bioreactor during normal operating conditions. The SAP will detail criteria for measuring steady state conditions; however, we expect these criteria to include stable perchlorate and nitrate destruction, stable ORP measurements, and stable DO measurements.

8. We are looking forward to a detailed sampling plan. The specific goals of what is to be determined by the study must be clearly defined. The sampling and analysis plan must be designed to generate the type and amount of data sufficient to satisfy the specific plan objectives. Phase 1 results should be taken into account while choosing the number of samples and sampling frequency. The plan should indicate what constituents will be analyzed. The plan should also indicate sampling locations and sampling frequencies for each constituent. EPA approved drinking water methods should be used for the constituents with an established method. The analytical method and the method PQL for each constituent should be provided in the plan.

   Response: The objectives of the Phase 2 Treatability Study are: 1. Confirm Destruction/Removal Efficiencies; 2. Establish Operating Parameters; 3, Collect Data to Support Permitting as Potable Water Source; and 4. Collect Data to Support Design of a Full-Scale System. The Sampling and Analysis Plan (SAP) will be designed to generate sufficient data to support these objectives and will take into account Phase 1 results. The SAP will specify analytical methods that are consistent with regulatory limits for various constituents detailed in Title 22. We look forward to working with you and your staff in developing a mutually acceptable SAP.

9. As mentioned previously, adequate data should be collected so that statistically-sound conclusions could be reached. We would accept that a difference of 10% (95% confidence level) in any operational parameters could be determined as statistically significant.

   Response: We agree. The Sampling and Analysis Plan (SAP) for the Phase 2 Treatability Study will be designed to provide a statistical confidence level of 95%.

10. The chemical additives used in the study must be on the NSF or UL drinking water additives certified list. If a proposed chemical is not on the list, the chemical that will be submitted for the certification process (American National Standard Institute/National Sanitation Foundation Standard 60) must be used.

    Response: The Phase 2 Treatability Study will utilize only food grade or NSF or UL, certified drinking water additives. For Phase 2 we are utilizing a different grade of ethanol, SDA 29, which contains only ethanol and ethyl acetate. To add phosphorus, we will utilize a food-grade phosphoric acid.

11. We need detailed design information on all treatment facilities and piping.

    Response: The Phase 2 Work Plan presents a conceptual design for the treatment facilities. Detailed design information will be available when the design drawings are complete. These will be forwarded to DHS at the earliest possible time.

Thank you for the opportunity to respond to your comments. Again, we look forward to working with the Department to resolve any outstanding concerns. Please call John Catts at (415) 899-8825, or Matthew McCullough at (909) 739-9593, or Jim Michael at (303) 293-6128 if we can assist you in any way.

Yours very truly,
HARDING LAWSON ASSOCIATES

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